

Landforms such as mountain ranges, plains, plateaus, gorges, bays, valleys, waterfalls, moraines and sand dunes, etc. on the Earth's surface (continents and oceans) originate, evolve and are destroyed under the influence of natural forces. Thus, when under the influence of natural forces, a part of the Earth's surface assumes a specific shape, slope and height, it is known as a '**Landform**'.

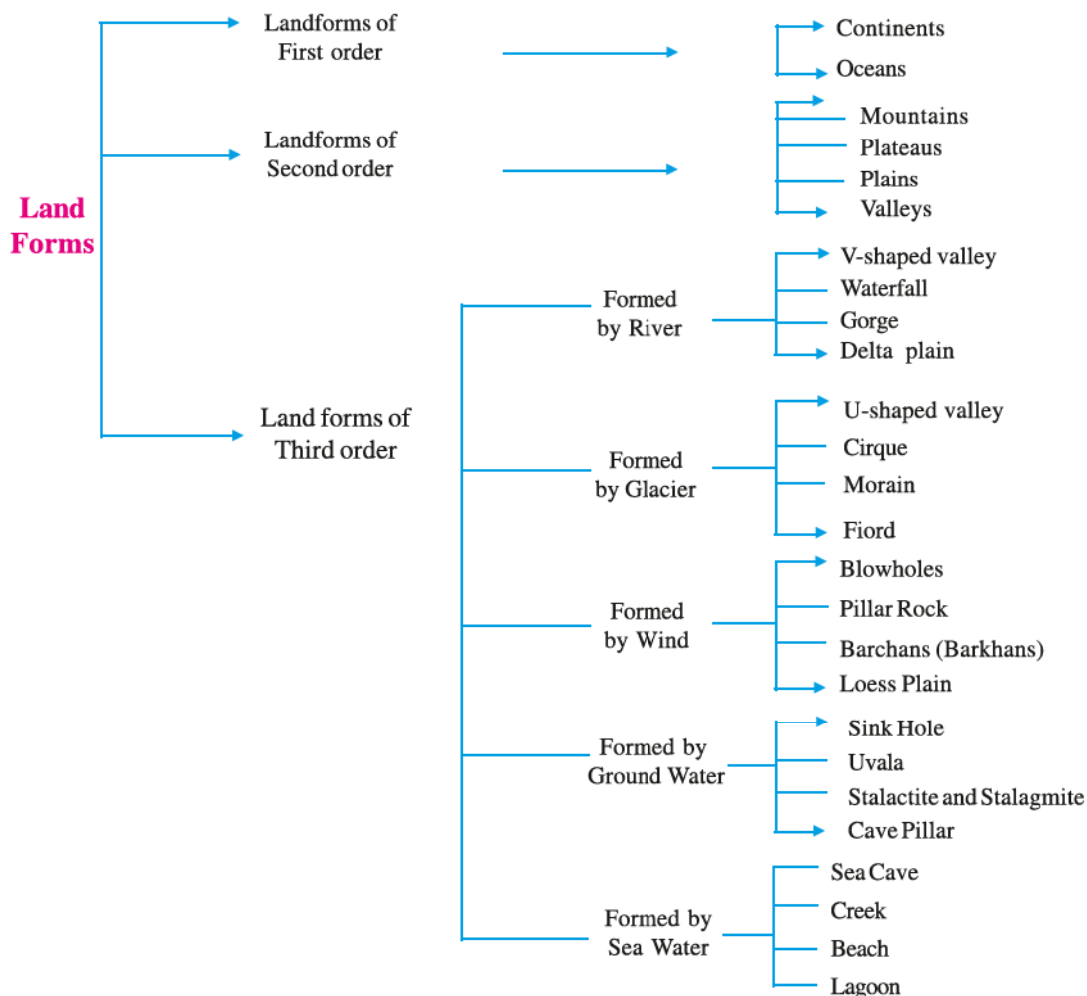
Origin of Landforms

The rocks present in the Earth's interior undergo expansion or contraction, followed by adjustment due to changes in the internal heat and pressure in the Earth. Earth movements originate due to this adjustment. As a result landforms such as mountain ranges, plateaus, plains and valleys, etc. originate on the Earth's surface. This process is known as earth movements.

Earth movements resulted in the formation of two major landforms such as continents and oceans. Hence they are known as landforms of the first order. Under the influence of internal forces, landforms of second order developed on them such as mountains, plateaus, plains, rift valleys, etc. On them, under the erosional and depositional work of external or mobile forces, various landforms were formed. V or U-shaped valley, waterfall, sand dunes, moraines, stack or sea cliff, etc. are categorized as landforms of the third order.

Types of major landforms

The landforms formed on the continents and ocean beds due to internal earth movements are known as major landforms. Mountains, plateaus and plains are the major landforms.



7.1 Classification of Landforms

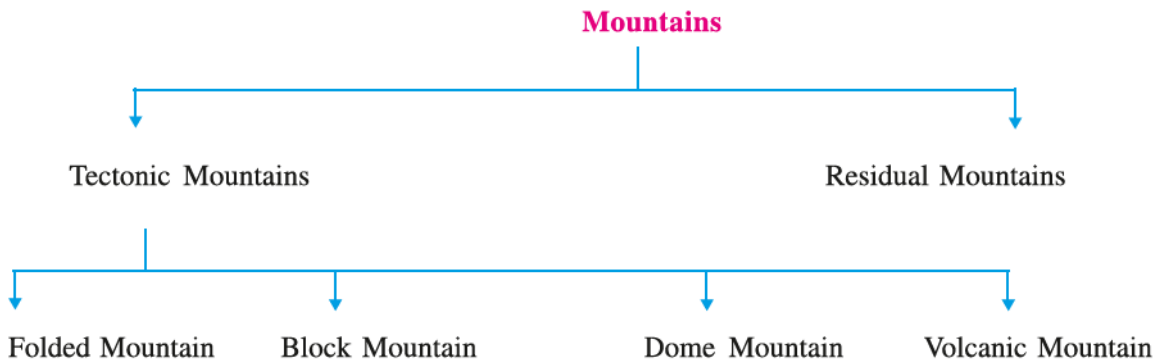
Major Landforms

Mountain : Mountains occupy about 26 % of the Earth's surface. Altitude is the main characteristic of mountain. A landform with an altitude of more than 900 m above sea level, uneven slopes and narrow summits is known as a mountain. In spite of these characteristics, height is not the true identity of a mountain. E.g., Tibet Plateau, although more than 5000 m in altitude, is not termed as a mountain. For this, altitude, shape and slope of a landform also need to be considered.

Types of Mountains :

According to the process of origin, mountains are of two main types :

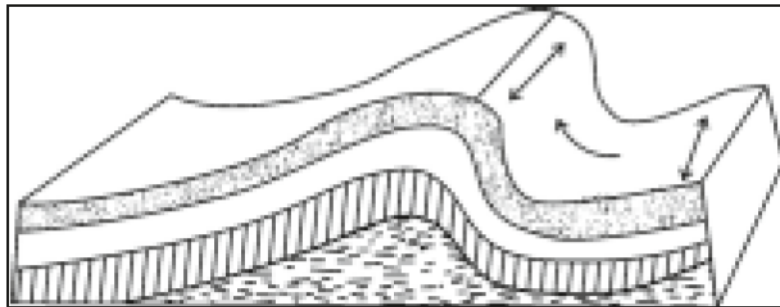
- (1) Tectonic mountains (2) Residual mountains



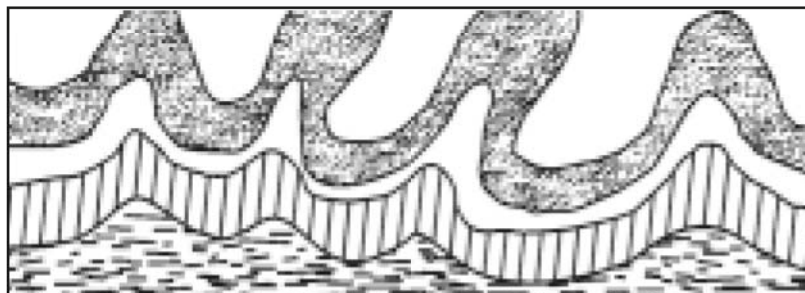
Types of Tectonic mountains

(1) Fold mountain : When in a region of sedimentary rocks bearing geosynclines, a compressional force is exerted in horizontal direction due to earth movement, folds are formed in it. If the compressional force persists for a longer time along with the process of upliftment, some parts get raised up as folds. These are known as fold mountains.

Fold mountains are formed of sedimentary rocks. Remnants of marine organisms and fossils are found in them. This proves that fold mountains have originated from the seas.



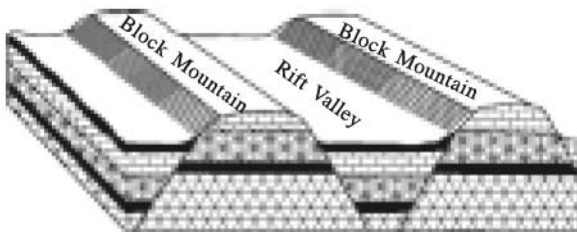
7.2 Folding-1



7.3 Folding-2

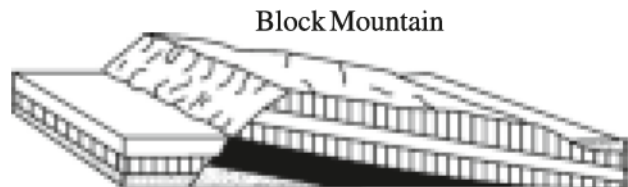
The fold mountains that were formed crores of years before are called old fold mountains. Examples are Appalachians in eastern part of North America, Urals of Russia, Apennine of Italy, Pennines of UK, Tsingling Shan of China and Aravallis of India. The Himalayas, Andes, Rockies and Alps were formed about 3 crore years before and are called young fold mountains.

(2) Block Mountains : Sometimes due to the Earth's internal forces, fissures or faults develop in the surface rocks. When due to Earth movements, a part of the land block between two vertical faults is uplifted, or it remains stationary and land blocks on either side of it subside, a block mountain is formed. If one of the sides of such a landform is steep and flat topped like a table, then it is called a **Plateau**. The middle portion that has subsided is called a **Rift Valley**. Block mountains are formed on either sides of a **Rift Valley**.



7.4

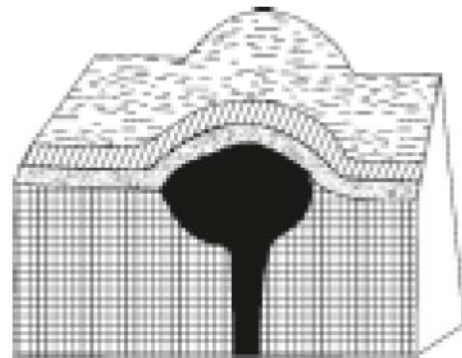
Block Mountain and Rift Valley



7.5

In Europe, Vosges to the west and Black Forest to the east of the rift valley of the Rhine river are examples of block mountains. Vindhyas lie to the north and Satpuras to the south of the Narmada rift valley. **Horst** mountain of Germany is an example of Block Mountain.

(3) Dome Mountain : Sometimes, magma in the Earth's interior tries to come out but solid rocks above it act as a barrier. Due to pressure of magma, rock layers get raised up in the form of a dome. It is known as Dome Mountain. When under the influence of forces of erosion, outer rock layers get eroded away, magma that has solidified in the interior becomes visible. Mountains near Sundha mata pilgrimage place in Rajasthan and mount Henry of Utah state in USA are examples.



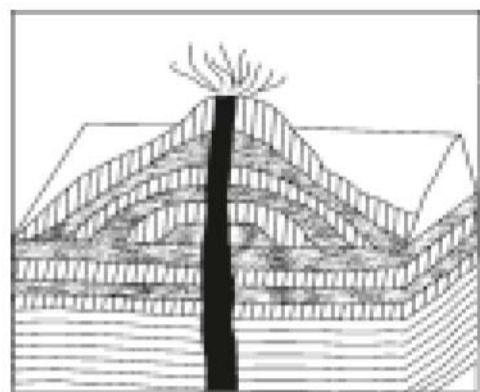
7.6 Dome mountain

(4) Volcanic Mountain : During a volcanic eruption, lava, ash, rock fragments, etc. are ejected from the Earth's interior and get accumulated around the vent forming a high cone shaped heap, known as a volcanic mountain. Since such a mountain is formed by accumulation of matter ejected from the Earth's interior, it is known as Mountain of accumulation.

Vesuvius of Italy, Etna of Sicily, Mt. Kilimanjaro of Kenya, Mt. Fujiyama of Japan, Mayon of Philippines, Krakatua of Indonesia, Popocatepetl of Mexico, Cotopaxi and Chimborazo of Equador are well known volcanic mountains of the world.

Relict mountains

When raised landforms such as mountains and plateaus are eroded down under the influence of forces of erosion, their remnants appear as cone shape, then such landforms are known as erosional or relict mountains. Examples are Vindhyaachal, Western Ghats and Eastern ghats, Parasnath in India, Wales in UK, and Ozark in USA.



7.7 Volcanic mountain

Significance of mountains :

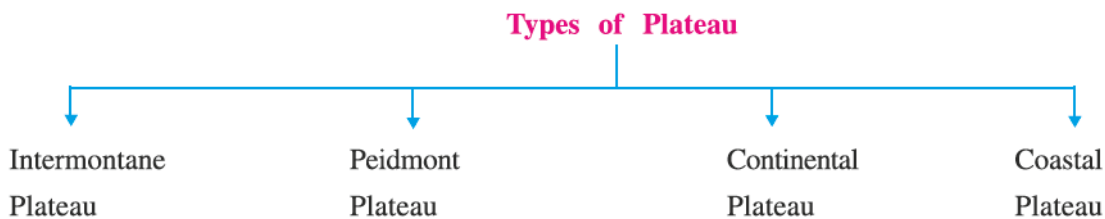
- Mountains located on land frontiers help to protect the country.
- Rivers, streams originating from mountain provide source of water.
- Alluvium, mud and organic matter deposited by rivers increase soil fertility.
- Various useful minerals are obtained from mountains.
- Timber, medicines and other forest products are obtained on montane forests.
- High mountains obstruct moist winds and help bring rain.
- Plantation crops like tea, coffee, fruits and other crops can be taken from mountain slopes.
- Mountainous regions become tourist spots.
- Waterfalls in mountains provide favourable sites for hydel power generation.

Plateau

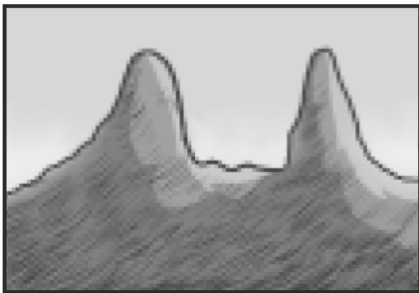
A landform more than 180 m above mean sea level with a flat top with atleast one side of very steep slope is known as a plateau. Figures of height are misleading just as the case with mountains. For example, the Praries plain of USA is higher than the Peidmont Plateau to its eastern part. Plateaus occupy 33 % of area of continents. Some scholars use the term Tableland for plateau.

Types of Plateau :

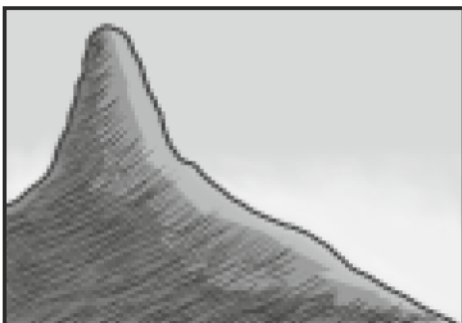
Plateaus are classified into four types according to their geographical location and mode of origin.



(1) Intermontane Plateau : A plateau surrounded from all sides by mountains is known as Intermontane Plateau. When compressional force acts on a geosyncline in horizontal direction, fold mountains are raised up and when its middle portion is raised up, the rock strata maintains its original condition without developing folds. Such middle portion is known as intermontane plateau. Slopes of intermontane plateau get mingled with mountain. Their altitude is more than other plateaus.



7.8 Intermontane Plateau



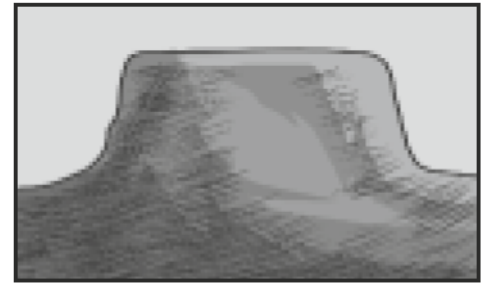
7.9 Piedmont Plateau

Tibet Plateau to the north of India is surrounded by the Himalayas, Bolivia Plateau of South America by the Andes and the Columbia Plateau of North America by the Rockies mountains.

(2) Piedmont Plateau : A plateau with high mountains on one side and slope culminating in low plains or sea coast is known as Piedmont Plateau.

Patagonia Plateau of South America and Piedmont Plateau of North America are examples.

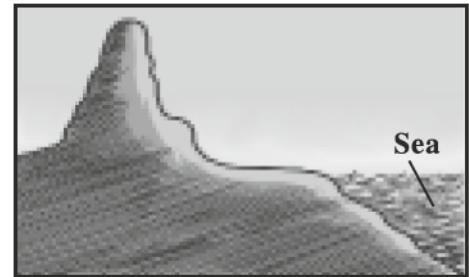
(3) Continental Plateau : Due to the disastrous forces operating in the Earth's interior, when the entire continent or a major part of it gets uplifted along with plain surface, such a landform is known as a Continental Plateau. Sometimes, due to fissure eruption, when lava spreads over wide areas and solidifies, a plateau of this type is formed. The Plateau of South India, Ethiopian Plateau in Africa, Greenland Plateau and Karroo Plateau of South Africa are formed by upliftment of continents.



7.10 Continental Plateau

(4) Coastal Plateau : Due to Earth movements, regions near the coast are raised higher up from the sea level or due to subsidence of coastal regions of continents, the remaining highland is known as a Coastal Plateau. Such plateaus have a continuity with the adjoining continental shelf.

Coromandel Plateau on the eastern coast of South India and Tanganyika Plateau of Africa are examples.



7.11 Coastal Plateau

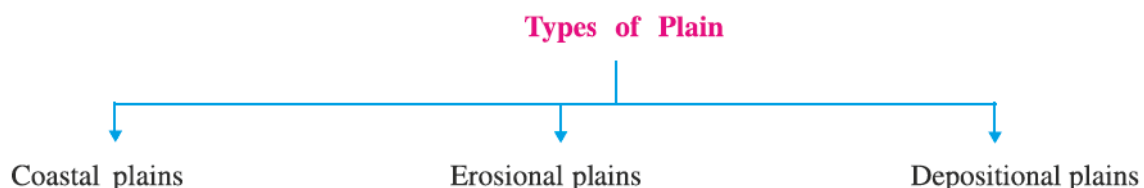
Significance of Plateaus :

- Plateaus are storehouse of minerals
- Black lava soils of plateaus is best for cotton crop.
- Grasslands of plateaus are favourable for animal rearing.
- Parts of plateaus with heavy rainfall are forested, from which forest products can be obtained, and this provides raw materials to industries.

Plains

The landforms with an altitude of less than 180 m, almost a flat surface and homogenous rock structure are known as plains. Just as with other landforms, figures for altitude of plains is also misleading. In USA, the altitude of plains of Prairies is 1500 m while in West Asia, the plain of Jordan river is even lower than sea level.

Plains occupy almost 41 % land area of continents. There are three main types of Plains :



(1) Coastal Plains : Plains near the sea coast are known as Coastal plains. Such plains are formed by the upliftment of continental shelf areas. Their slope is seawards. Rivers bring alluvium from the interior of continents and deposit in such plains to make them flat.

Sometimes coastal plains are formed by erosion also. Due to saline soils, such plains are mostly useless for agriculture. Such plains are Malabar in India and east coast plains of Japan.

(2) Erosional Plains : Forces of denudation and erosion such as river, glacier and wind play a role in the formation of such plains. Due to continuous erosion work of mobile forces, mountains and plateaus get eroded and flattened. Soft rocks are rapidly eroded, while hard rocks are eroded slowly at their places. Such plains are known as Peneplain.

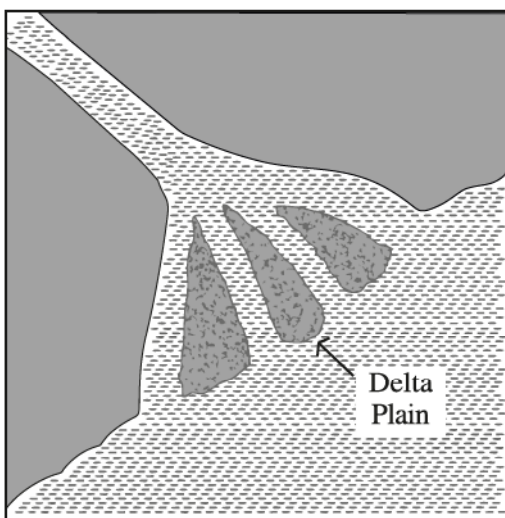
Plains formed by river erosion are Aravalli region to the west of Delhi, plain of East England, central plains of Russia, Paris Basin.

Glaciated plains are located in Canada, Norway, Sweden, Finland, etc.

Wind-eroded plains are found in desert regions with dry conditions and scanty rain.

(3) Depositional Plains : Deposition work is done by mobile forces such as river, glacier and wind. When their carrying capacity to transfer load declines deposition is done. Thus Depositional Plains are formed.

When a river enters a plain from a mountainous region, it deposits gravel, boulders, and sand near its valley to form a Alluvial Plain. It is known as Alluvial fan plain due to its typical shape. When a river is flooded, its waters spread on either sides of its banks. Thus flood plains are formed due to silt deposition. When a river meets the sea, due to its sluggish flow it deposits huge amount of silt at its mouth, where a delta plain is formed. Due to its high fertility, it is best for agriculture.



7.12 Delta

There are certain requirements for the formation of a Delta: (1) The river should have water all the year round. (2) The river should have huge amount of load. (3) When a river meets the sea, its flow should be slow. (4) It is necessary that the sea is free of stormy waves, currents and high tide.

Ganga, Brahmaputra and Godavari rivers in India, Mississippi river in USA, Nile river in Egypt, Irrawaddy river in Myanmar, etc have formed delta plains.

When a glacier melts, materials embedded in it spread around. Plain formed by this depositional work of glacier is known as a Drift Plain. Canada, Norway, Sweden and Greenland located in high latitudes have such plains.

When load carried by wind faces an obstacle or slows down, it gets deposited. The plain formed as a result is known as **Loess**. Plains of yellow clay in China is its best example.

Significance of Plains : Plains have played a great role in the development of man. Ancient civilizations developed in plains. Agriculture, industry, transport, trade and such other activities get opportunity to develop in plains. About 75% of worlds population resides in the plains. Some of the worlds biggest cities have developed in plains. Here, literature, art, music, sculpture, etc. originated, flourished and developed.

Geomorphic Processes : Because of Earth movements, mountains, plateaus, plains, valleys are formed on the Earths surface. Exogenetic forces of erosion begin their disintegration. Thus, nothing is permanent on the Earths surface. The prime source of exogenetic forces is the **Sun**. It is because of it that forces that reduce relief such as wind, river, glacier, sea waves originate. Because of their three processes of erosion, transportation and deposition, landforms originate and are destroyed. Forces that reduce relief are of two types : (1) Static forces (2) Mobile forces.

(1) Static forces :

The forces that break matter in situ are known as static forces. The Sun's heat, humid air, snow, rain, plant roots, animal life and humans are included in it. These forces don't have mobility and hence are known as static forces. These forces break rock layers near the surface, resulting in weathering.

Weathering

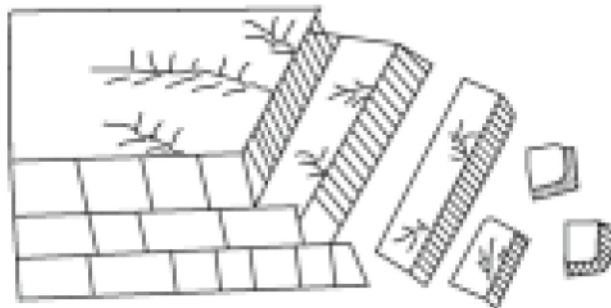
When rocks exposed at or near the Earth's surface disintegrate and decompose at their own place under the action of physical, chemical and biological processes, it is known as **weathering**. Weathering is of two main types : (1) Physical weathering (2) Chemical weathering

(A) Physical weathering : Under the influence of temperature, rain, snow, vegetation and human activities, rocks are broken. Their physical form changes but no change occurs in chemical composition. Hence it is known as physical weathering.

Temperature : The exposed rocks get heated up from the Sun's heat. This results in their expansion leading to an increase in volume. Temperature decreases during night resulting in contraction. The process is continuously repeated, leading to formation of cracks in rocks. After some time rocks are broken into small and big pieces. This is known as **Block disintegration**. Such type of weathering is mainly seen in basalt rocks.

Various minerals have unequal capacity of expansion when heated and contraction when cooled. This unequal expansion and contraction separates small and big grains from rocks. It is known as **Granular disintegration**. Granular weathering is seen in sandstone and basalt rocks.

In rocks with various layers, layers get detached one after another. It is known as **Exfoliation**. Such type of disintegration is common in basalt rocks.



7.13 Block Disintegration



7.14 Exfoliation



7.15 Granular Disintegration

Snow

In high mountains and the cold regions of high altitudes, water filled in the cracks during day time gets frozen into ice during night. Ice occupies more space than water. This exerts pressure on the sides of rocks. This gradually widens the cracks. After some time this results in block disintegration of hard rocks and granular disintegration of porous rocks.

Due to continuous eroding by rain or wind, rocks break down at their own place. Plant roots penetrate into cracks in rocks and break them. Some insects and animals dig into soils and rocks to burrow, breaking rocks in the process. Human economic activities like mining also disintegrates rocks.

(B) Chemical Weathering : Rocks are composed of several minerals. Temperature, water vapour and contact with gases causes changes in mineral composition. Rocks weaken and undergo weathering. This process is known as chemical weathering. Oxidation, carbonation and hydration are chief processes among them.

In regions having monsoon climate, oxygen gas in free state or as a water compound reacts with rocks having iron content to form oxide (rust). This process is known as oxidation.

Rain water reacts with atmospheric carbon dioxide to form weak carbonic acid. It chemically reacts with minerals to form carbonates. This process is known as carbonation. As a result rocks weaken and decompose. Its effect can be seen on limestone and marble.

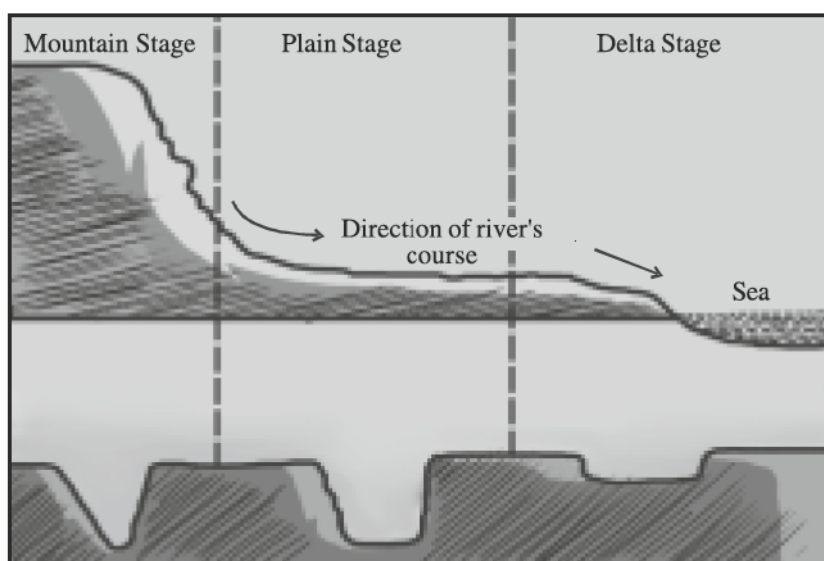
Mobile Forces : Forces that transport material from one place to another and cause denudation of rocks are known as mobile forces. Such forces are flowing water (river), glacier, wind, ground water and sea waves. These forces shape different landforms through the processes of erosion, transportation and deposition.

(1) Flowing water (river) : A natural flow of water downslope under the influence of gravity is known as a river.

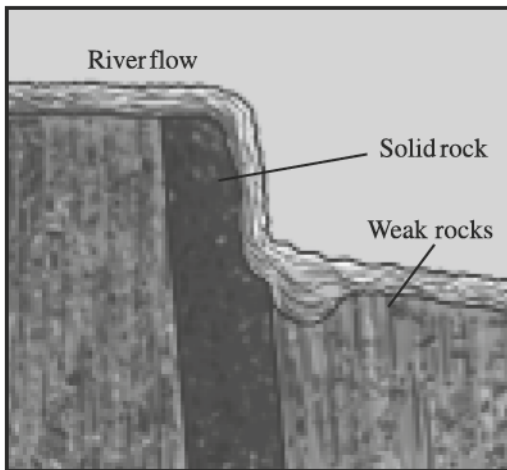
Flowing water gradually removes slope related ruggedness that comes in its course, resulting in a characteristic topography. Thus work of river is divided into three types- erosion, transportation and deposition.

Erosional work

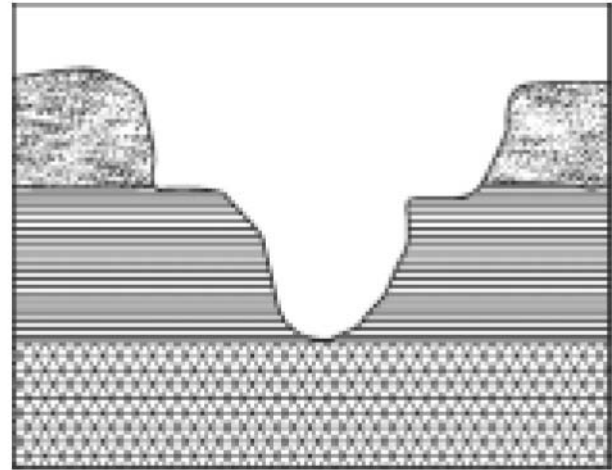
A river breaks rocks that come in its course which becomes its load. It acts as tools in erosion process. Thus erosion depends on mass of load, volume, shape, slope of river bed, composition of rocks and river velocity. Landforms such as V-shaped valley, waterfall, gorge, structural terraces, etc. are formed by river erosion.



7.16 Development of River Valley



7.17 Waterfall



7.18 Structural terraces

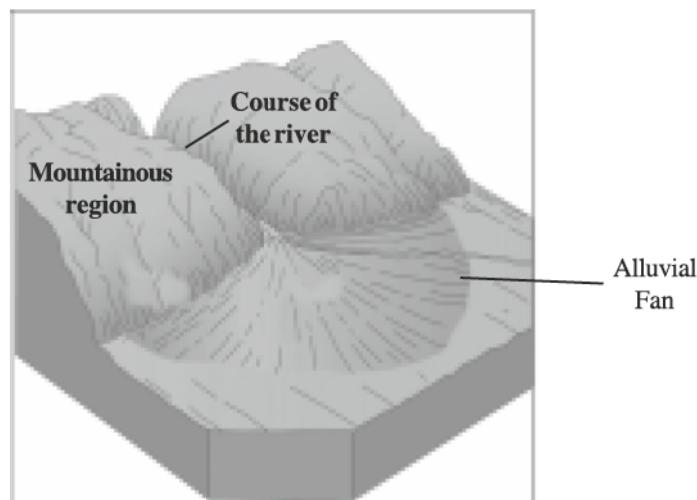
Transportation-work :

The load obtained by a river through its erosional work is carried from one place to another. This is work of transportation of a river. Soluble matter moves ahead in the form of solution. Small particles move as suspension, while bigger particles move ahead by jumping, rolling or are dragged downstream.

Depositional Work :

The load obtained through erosional work begins to settle down with decline in water velocity. This process is known as Deposition.

Alluvial cones, alluvial fans, flood plains and deltas are formed by such deposition.

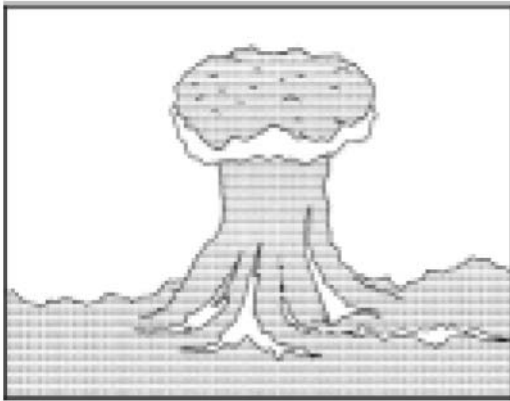


7.19 Peidmont Plain (Alluvial Fan)

(2) Wind : Wind is also significant among the mobile forces. In the regions with high temperature, scanty rain, arid or semi-arid conditions work of wind is more significant. Wind also shapes various landforms through the processes of erosion, transportation and deposition.

Erosional work

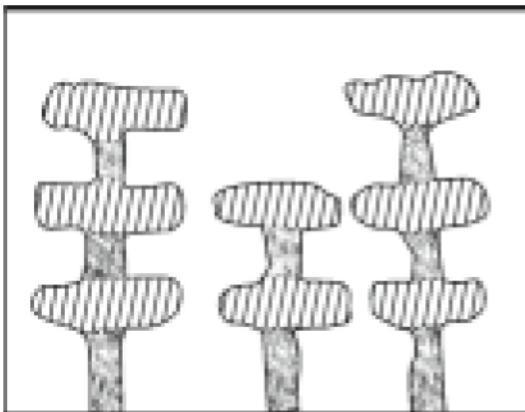
Wind carries matter that comes in its course along with it, using it as a tool to erode the rocks. This leads to formation of several landforms such as deflation basin, mushroom rock, zeugen, yardang, inselberg, etc. It is known as the erosional work of wind.



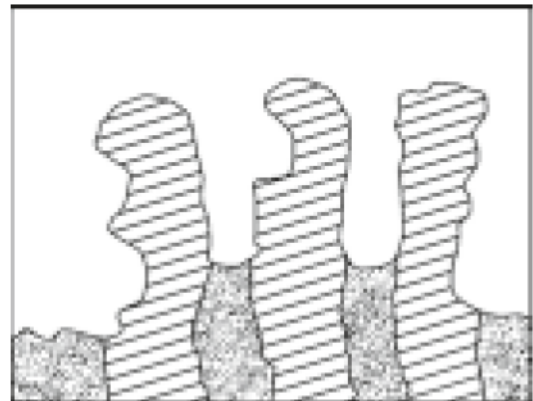
7.20 Mushroom rock



7.21 Inselberg



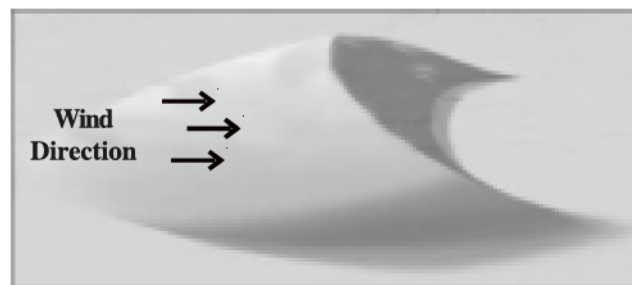
7.22 Zeugen



7.23 Yardang

Depositional work

The load gained by wind from its erosional work gets deposited when wind speed declines and barriers such as scrub-vegetation, trees or higher rock parts come in its way. This is known as wind deposition. Sand dunes, Barchans and loess plains are formed by this process.



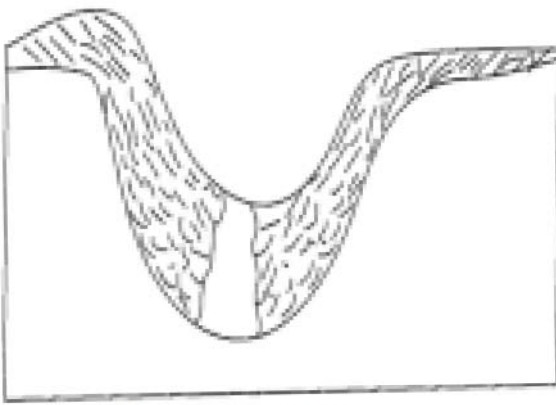
7.24 Barchans

(3) Glacier :

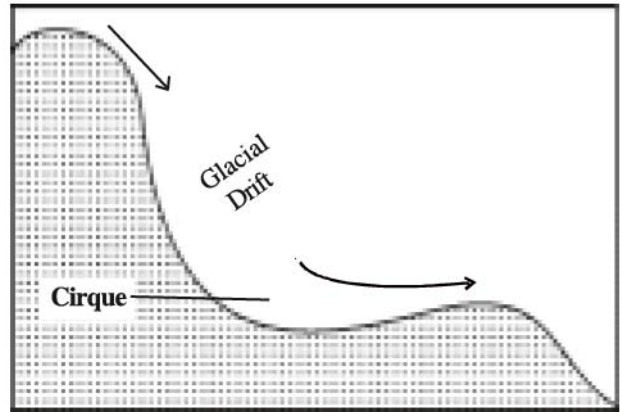
Snowfall is common in regions of high latitudes and high mountainous regions. The snow accumulated from this snowfall gradually moves downslope. Such a slowly moving mass of snow is known as a '**Glacier**'. It also produces various landforms through erosion, transportation and deposition work.

Erosional work

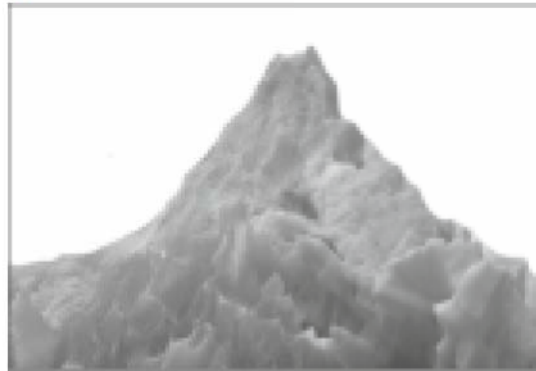
The rock fragments or such other load that come in the way of a glacier, is trapped in the snow. This works as the tool of erosion. U-shaped valley, hanging valley, cirque, arête and fiord coast are formed as a result.



7.25 U-shaped Valley



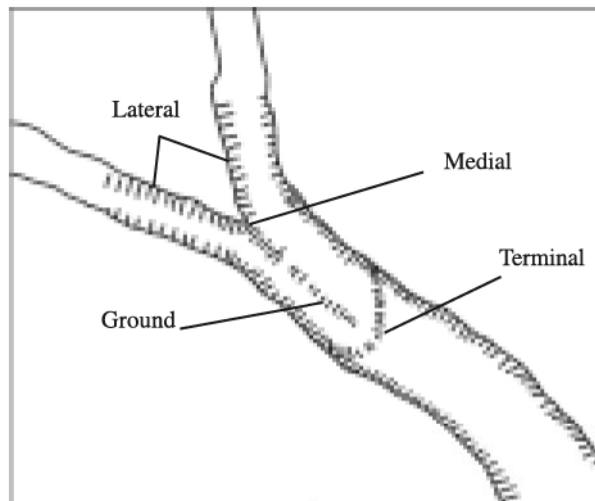
7.26 Cirque



7.27 Glacial Peak

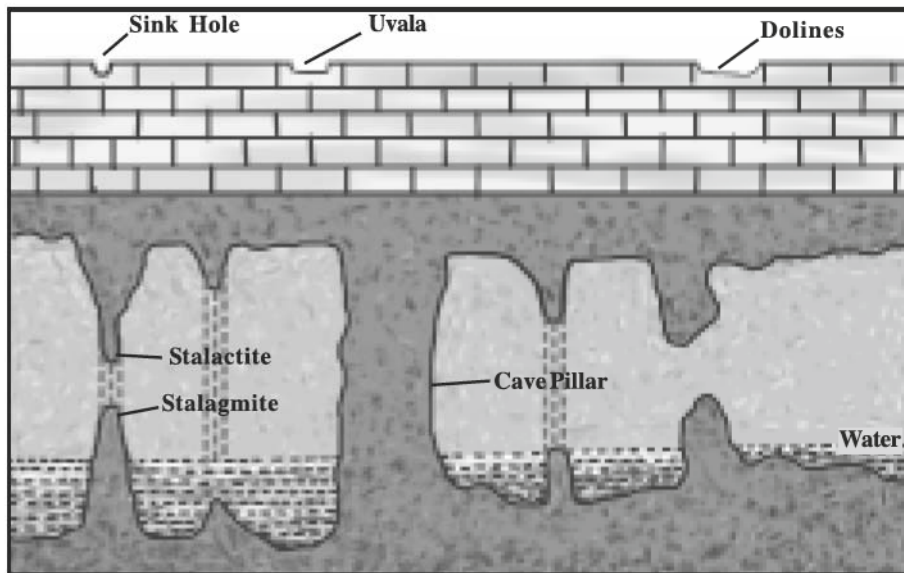
Depositional work

When a glacier slides below the snow line, it begins to melt. Thus the load trapped in it begins to be deposited in various parts of its route. This is known as depositional work of a glacier. **Moraines** are formed from this deposition. Depending on location, they are known as lateral, medial, ground and terminal moraines.



7.28 Moraines

(4) Groundwater : Water obtained from precipitation gets deposited inside porous rock layers. This water is known as groundwater. Rainwater in solution form percolates in the lower layers and denudes the rock material coming in its way. Characteristic landforms are formed in regions of limestone. It is known as **Limestone topography** or **Karst topography**.



7.29 Karst Topography

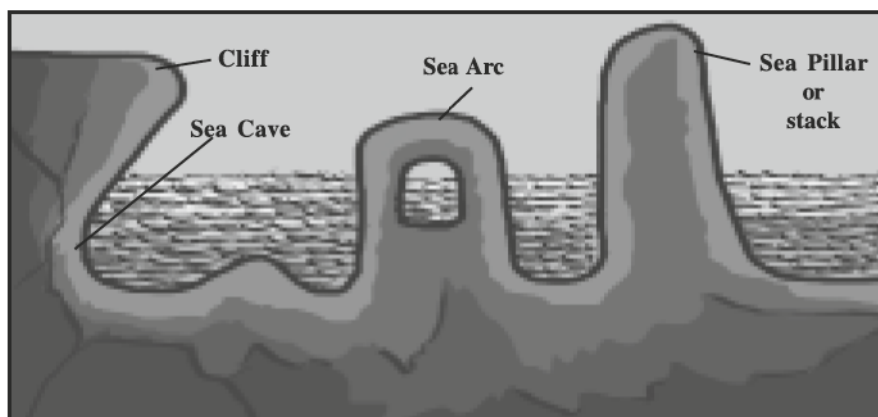
The surface water forms several holes in joints present in limestone layers. These are known as sink holes. When the size of sink holes increases due to erosion, they are known as uvala, dolines and polje.

As the ground water penetrates deeper, lime deposits on the ceiling and floor of a limestone cave. Such deposits develop into stalactite, stalagmite and cave pillars. If the roof of the cave collapses, huge craters are formed known as Polje.

(5) Sea waves : Work of sea waves is limited to the coastal regions. Besides waves, tides and ocean currents also develop various landforms.

Erosional work :

Erosional work by sea waves depends on velocity and pressure of water, size, shape and length of waves and height of the coast etc. Sea waves strike the coast with a great velocity. As a result, rocks of the coast are broken. The process goes on continuously. Several erosional features develop as a result. Sea cliff, sea cave, stack, coves or mini-bays, etc. are formed.



7.30 Erosional work of sea water

Deposition :

Sea waves deposit the load obtained by erosion on the sea coast. It is known as the depositional work of sea waves. Landforms such as beaches, sand bars, etc. are formed by it. Lagoons are formed when sea water is completely enclosed by bars. Chilka of Orissa and Pulicat of Tamil Nadu are examples of lagoon lakes.

EXERCISE

1. Answer the following questions in detail :

- (1) Define mountain, and write a detailed note on types of mountain.
- (2) What is physical weathering ? Describe its types.
- (3) Explain the erosion, transportation and depositional work of wind.

2. Answer the following questions in brief :

- (1) How many types of major landforms are there ? Which are they ?
- (2) Write a short note on dome shaped mountain.
- (3) Explain the formation of peneplains.
- (4) Write about the depositional work of ground water.

3. Answer the following questions in one-two sentences :

- (1) Mention the names of landforms of first order.
- (2) Which are the two main types of mountains ?
- (3) Which are the two main forces that reduce relief ?
- (4) What are moraines ?

4. Select the correct option from the options given and write the answer :

- (1) Which is landform of the second order ?
(a) Continent (b) Pillar (c) Plain (d) Waterfall
- (2) Which of the following is a fold mountain ?
(a) Fujiyama (b) Himalayas (c) Henry (d) Vindhya
- (3) What % of continental area is occupied by plains ?
(a) 41 % (b) 33 % (c) 29 % (d) 21 %
- (4) Which is the prime source of exogenetic forces ?
(a) River (b) Wind (c) Sun (d) Vegetation
- (5) A lake formed of sea water is known as ?
(a) Pond (b) Bandhara (c) Lagoon (d) Bay

Activity

- Draw diagrams of various landforms and arrange for an exhibition.